

# Desktop Laser Engraver User Manual



Read Carefully Before Use  
Keep for Future Reference

# PREFACE

Thank you for choosing our laser equipment.

Your CO<sub>2</sub> laser engraving machine is intended for personal and professional use. When used in accordance with these instructions, it comprises a Class 1 laser system but some components remain **EXTREMELY** dangerous. Never disable the preinstalled safety devices and always use your laser safely and responsibly.

Read this manual carefully before operation. It covers the details of correct installation, adjustment, maintenance, and—most importantly—safe operation of your new laser. You and any other users of this device should thoroughly understand the manual before attempting to operate the laser.

Keep the manual for future reference and provide it to **ANYONE** who will install, operate, maintain, or repair this machine. The manual should be included if this device is given or sold to a third party.

If you have any questions after reading the manual, please contact us and our support department will address your concerns as soon as possible.

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# **1. Introduction**

## **1.1 General Information**

This manual is the designated user guide for installation, setup, safe operation, and maintenance of your desktop laser engraver. It is divided into six chapters covering general information, safety instructions, installation steps, operation instructions, maintenance procedures, and contact information.

**ALL** personnel involved in the installation, setup, operation, maintenance, and repair of this machine should read and understand this manual, particularly its safety instructions. Some components are extremely high voltage and/or produce powerful laser radiation. Substandard performance and longevity, property damage, and personal injury may result from not knowing and following these instructions.

Your laser engraver works by emitting a powerful laser beam from a glass tube filled with insulating carbon dioxide (CO<sub>2</sub>). The laser beam reflects off three mirrors and passes through a focus lens, after which the focused light can etch designs into certain substrates. The first mirror is fixed near the end of the laser tube, the second mirror travels along the machine's Y axis, and the third mirror is attached to the laser head that travels along the X-axis. Because some dust from the engraving process settles on the mirrors, they require frequent cleaning. They also require periodic readjustment using their attached positioning screws to maintain proper laser path alignment. A water cooling system—typically a pump or chiller—must be used with this engraver to dissipate the heat produced by the laser tube. Similarly, an exhaust system—typically either an external vent or a dedicated air purifier—must be used to remove the dust and gases produced by the engraving process.

With low intensity use, the provided laser tube has an average lifespan around 2000 working hours before requiring replacement. The provided power supply should also last around 2000 hours under similar conditions. However, constantly running your laser above 70% of its maximum rated power can significantly shorten their service lives. It is recommended to use 10–70% of the full rated capacity to enjoy optimal performance and longevity.

Note that this is a high-voltage device and, as a safety precaution, it is recommended to only touch its components with one hand at a time during use.

Note that the active laser is invisible to the human eye. Never operate this device while any cover is open to avoid potentially permanent injury.

Note also that the water cooling system and exhaust system are both absolutely essential to the safe use of this device. Never operate the engraver without both of these systems working correctly. Cooling water should always be kept clean and around room temperature, and the exhaust system should always comply with all applicable laws and regulations for workplace and environmental air quality.

## 1.2 Symbol Guide

The following symbols are used on this machine's labeling or in this manual:



These items present a risk of serious property damage or personal injury.



These items address similarly serious concerns with regard to the laser beam.



These items address similarly serious concerns with regard to electrical components.



These items address similarly serious concerns with regard to fires.



Protective eyewear should be worn by anyone around this machine during operation.



This product is sold in conformity with applicable EU regulations.



This product contains electrical components that should not be disposed of with regular garbage.

## 1.3 Designated Use

This machine is intended for use engraving signs and other consumer products on applicable substrates. This laser can process a wide variety of materials, including wood and cork, paper and cardboard, most plastics, glass, cloth and leather, and stone. It can also be used with some specially coated metals. Use of this system for nondesignated purposes or materials is not permitted.

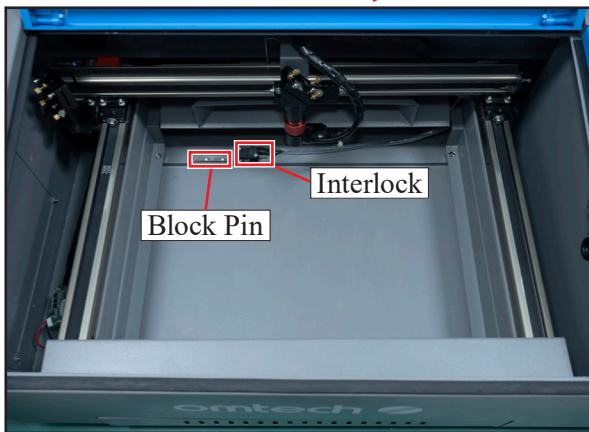
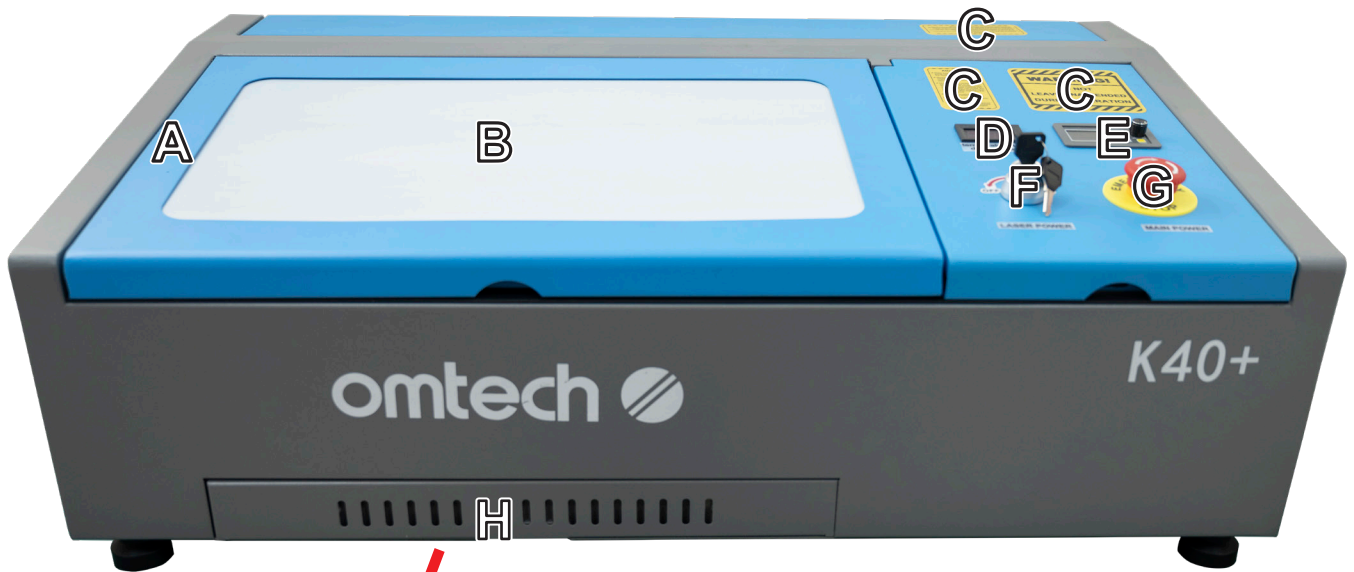
The system must be operated, maintained, and repaired by personnel familiar with the field of use and the dangers of the machine. The material being engraved must be deemed safe for laser exposure, including its reflectivity, conductivity, and potential for creating harmful or combustible fumes, etc.

Laser beams are dangerous. The manufacturer and/or seller bear(s) no responsibility and assume(s) no liability for any improper use of this device or any damage or injury arising from such use. The operator is obliged to use this desktop laser engraver only in accordance with its designated use, the other instructions in its manual, and all applicable local and national laws and regulations.

## 1.4 Technical Specifications

<b>Model</b>		USB3020N	
<b>Laser Tube</b>	<b>Diameter</b>	1.97 in.	50 mm
	<b>Length</b>	28.3 in.	720 mm
<b>Focus Lens</b>	<b>Diameter</b>	0.47 in.	12 mm
	<b>Thickness</b>	0.08 in.	2 mm
	<b>Focal Length</b>	2 in.	50.8 mm
<b>Mirror</b>	<b>Diameter</b>	0.79 in.	20 mm
	<b>Thickness</b>	0.12 in.	3 mm
<b>Input Power</b>		110–120 V~ 60 Hz	
<b>Power Consumption</b>		360 W	
<b>Rated Power</b>		40 W	
<b>Expected Service Life</b> at <40% / 40–70% / >70% Power		2000/1200/600 hr.	
<b>Laser Wavelength</b>		10640 nm	
<b>Processing Area</b>		12×8 in.	300×200 mm
<b>Max. Processing Speed</b>		11.8 ips	300 mm/s
<b>Max. Acceleration</b>	<b>X-Axis</b>	78.7 ips <sup>2</sup>	2000 mm/s <sup>2</sup>
	<b>Y-Axis</b>	59.1 ips <sup>2</sup>	1500 mm/s <sup>2</sup>
<b>Min. Engraving Depth</b>		0.008 in.	0.2 mm
<b>Max. Engraving Depth</b>		0.12 in.	3 mm
<b>Max. Resolution</b>		500 dpi	
<b>Max. Engraving Material Thickness</b>		1.2 in.	30 mm
<b>Min. Line Width</b>		0.02 in.	0.51 mm
<b>Precision</b>		±0.01 in.	±0.25 mm
<b>Required Operating Environment</b>	<b>Max. Humidity</b>	70%	
	<b>Temp. Range</b>	40–95°F	5–35°C
<b>Provided Operating Software</b>		LaserGRBL	
<b>Supported Operating Software</b>		LightBurn	
<b>Supported Image Formats</b>		.ai, .bmp, .dxf, .emf, .gif, .hpgl, .jpeg, .pdf, .plt, .png, .rd, .svg, .tiff, .tga, .wmf	
<b>Graphic Operating Modes</b>		Raster, Vector, Combined	
<b>Certification</b>		CE, FDA	
<b>Net Weight</b>		66.14 lb.	30 kg

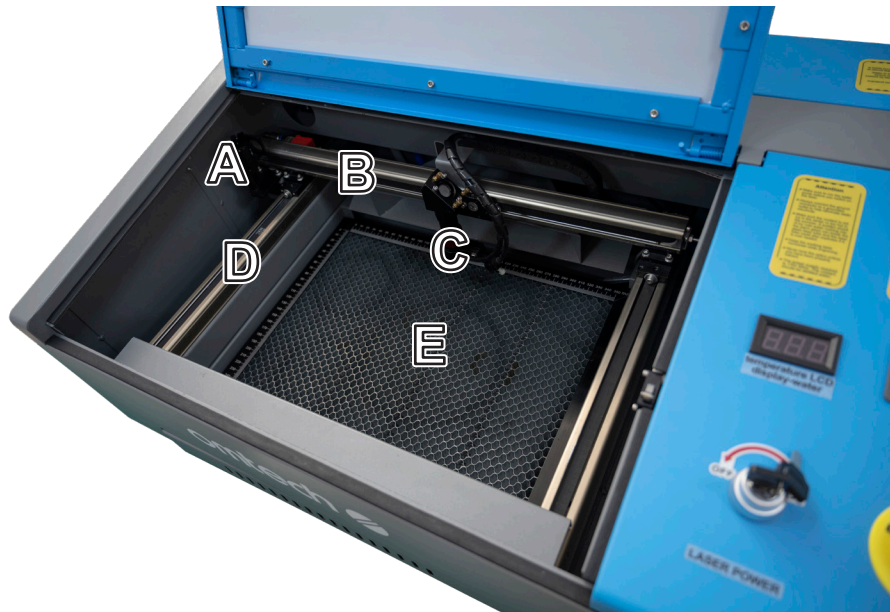
## 1.5 Components



## Main Parts

- A. Cover**—The cover provides access to the main bay for placing and retrieving materials, as well as fixing the laser path alignment and other maintenance. Power to the laser is automatically cut when the cover is opened.
- B. Viewing Window**—The polycarbonate window is shielded to protect you and others from the laser and its reflection, allowing monitoring of the engraving process. However, you should never stare continuously at the laser during operation, even through the window.
- C. Warnings**—These notices supplement the Safety Information chapter of this manual. Read them carefully before using the machine and contact our customer service or tech support teams if you have any questions or concerns.
- D. Temperature Gauge**—This gauge monitors the temperature of your laser tube’s cooling water in degrees Celsius ( $\pm 3^{\circ}\text{C}$ ). Do not allow the reading to exceed  $38^{\circ}\text{C}$ . If the temperature approaches this value, stop work and allow your device to cool before further use.
- E. Ammeter**—This digital display shows the current being provided to the laser tube in mA. The knob to its right is its master power control. It should be turned completely clockwise to enable the software to use the engraver's full power range and can be used as master control for the laser’s power settings. When it is set to anything other than 100%, it reduces the engraving software or control panel’s power settings by a proportionate amount.
- F. Laser Key**—This key controls the power supply to your laser tube and air assist.
- G. Emergency Stop**—Pushing this button cuts all power to the laser tube immediately in the event of an emergency. Release it during startup to turn on your engraver's control system, exhaust fan, and water pump socket. Turn it on before the laser key and turn it off after.
- H. Debris Tray**—This tray is for collecting debris. Empty it regularly. There is also an emergency shutoff interlock for the tray. Remove the tray and pin the interlock down using the in-built block pin before using a rotary axis to work on larger round workpiece. Do not forget to place a sacrificial base, preferably a non-reflective steel sheet, between your table and engraver.
- I. USB Port**—This connects to your control computer and its engraving software.
- J. Feet**—These feet help anchor the machine in place.
- K. Vents**—These vents keep components from overheating during prolonged use and should not be obstructed.
- L. Rear Access Door**—This door opens to the laser bay, holding the laser tube and its connections.
- M. Laser Tube**—This long glass tube is filled with helium, nitrogen, and  $\text{CO}_2$  gas and water cooled to safely produce your engraving laser. Its connection to the laser power supply is extremely high voltage and extremely dangerous.
- N. Water Sensor (not shown but attached to the water outlet)**—This device provides the reading for the control panel's water temperature gauge.
- O. 1st Mirror**—This adjustable-angle mirror is fixed in place to transfer the engraving laser from the tube to the 2nd mirror.
- P. Power Socket**—This socket connects to your main power supply. Be sure that the supply is stable and matches the voltage on the label above the socket.
- Q. Ground Connection**—This socket must be connected to a safe electrical ground if your location does not have a well-grounded 3-prong outlet.
- R. Water Pump Socket**—This socket connects to your water pump if needed. It is recommended, however, to use a separate plug on a different fuse for it.
- S. Exhaust Fan**—This fan pulls out gases and airborne debris from the worktable, sending it through your vent to a window or air purifier.
- T. Water Tubes**—The blue line brings cooling water from your pump or chiller to keep your laser tube cool and stable and the other line returns it.

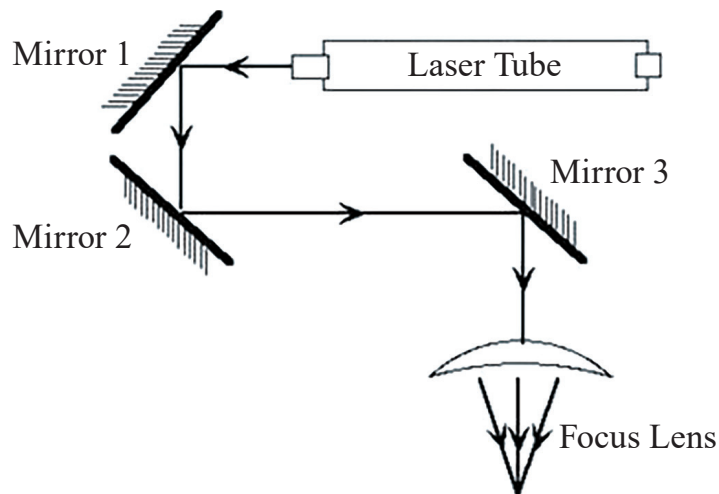


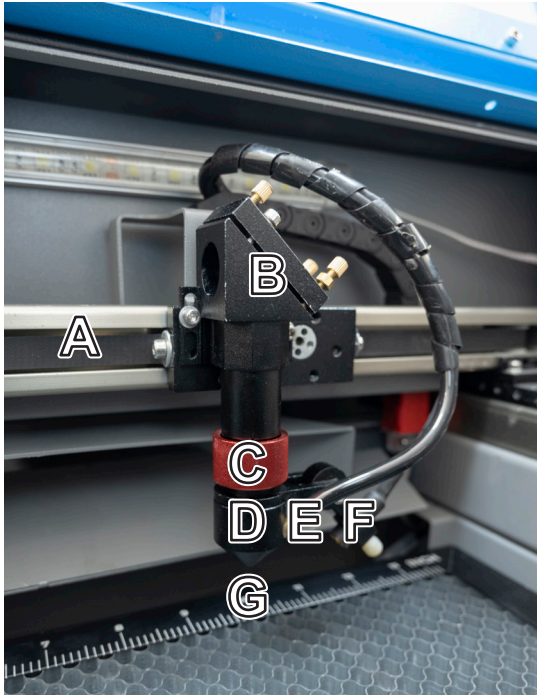


## Main Bay

- A. **2nd Mirror**—This adjustable-angle mirror moves with the X-axis rail to allow the laser beam to travel along the Y axis.
- B. **X-Axis Rail**—The X-axis rail holds the 2nd mirror and supports the movement of the laser head left and right across the workbed.
- C. **Laser Head**—The laser head holds the 3rd mirror, the focus lens, the air assist outlet, and the red dot guidance.
- D. **Y-Axis Rail**—The Y-axis rail supports the movement of the X-axis rail up and down the workbed.
- E. **Honeycomb Workbed**—The removable workbed provides protection for the debris tray below. The honeycomb bed can be removed to make way for thicker laserable workpiece.

## Laser Path





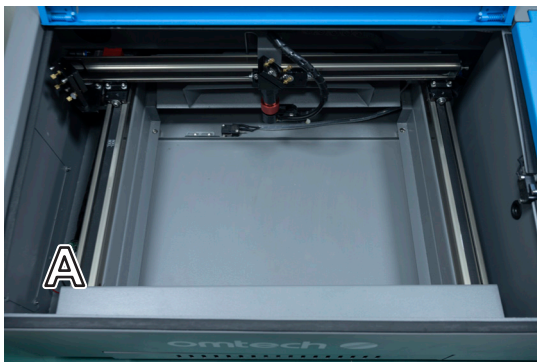
## Laser Head

- A. **X-Axis Rail**—This rail moves along the Y axis, with its movement controlled by limit switches.
- B. **3rd Mirror**—This adjustable-angle mirror transfers the laser from the 2nd mirror to the focus lens.
- C. **Manual Focusing Knob**—This knob can be loosened to allow the laser head to move up or down as needed for manual focus adjustment. Retighten the knob before use.
- D. **Focus Lens**—This 12 mm lens directs and focuses the laser beam to its point of contact with the engraving material.
- E. **Air Assist**—This device blows pressurized air to kill sparks and blow away gas and debris as you engrave.
- F. **Red Dot Pointer**—This device helps you see the exact position of the invisible engraving laser.
- G. **Laser**—The engraving laser itself is invisible but highly dangerous. Avoid any direct exposure to your skin or eyes.



## Internal Wiring

- A. **Low-voltage Power Supply**—This device provides power for low-voltage components such as the motherboard, air pump, and light.
- B. **Laser Power Supply**—This device transforms standard electricity into the extremely high voltage charge necessary for the laser tube.
- C. **Terminals**—These terminal blocks hold your wiring in place for easier part replacement when needed.
- D. **Motherboard**—This circuit board controls the engraving process, responding to commands from your engraving software.



## Air Assist Pump

- A. **Air Assist Pump**—This pump blows away the minute debris and smoke away from the laser lens, preventing debris from building up and thus lengthening the service life of the laser head.

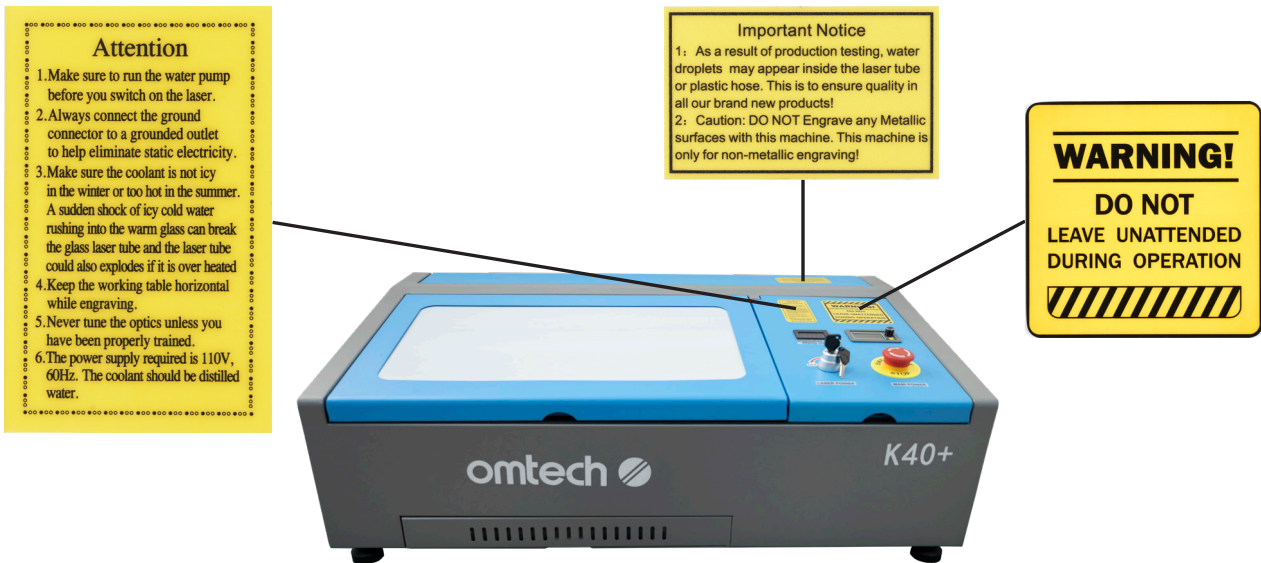
## 2. Safety Information

### 2.1 Disclaimer

Your engraver may differ somewhat from those shown in this manual due to options, updates, etc. Please contact us if your engraving machine came with an outdated manual or if you have any other questions.

### 2.2 General Safety Instructions

- Your device should come with safety precaution labels such as those seen below:



If any labels are missing, illegible, or become damaged, they must be replaced.

- Use this laser engraving device only in accordance with all applicable local and national laws and regulations.
- Use this device only in accordance with this instruction manual. Ensure that this manual is included with this device if it is ever given or sold to a third party.
- DO NOT** operate continuously for more than 2 hours. Stop for at least 30 minutes between uses.
- DO NOT** leave this device unattended during operation. Observe the device throughout operation. If anything seems to be operating strangely, immediately cut off **ALL** power to the machine and contact either our customer service or your dedicated repair service. Similarly, ensure the device is **FULLY** turned off after each use.
- DO NOT** allow minors, untrained personnel, or personnel suffering from a physical or mental impairment that would affect their ability to follow this manual to install, operate, maintain, or repair this device.
- Any untrained personnel who might be near the device while it is in operation **MUST** be informed that it is dangerous and fully instructed on how to avoid injury during its use.
- Always keep a fire extinguisher, water hose, or other flame retardant system nearby in case of accidents. Ensure that the local fire department's phone number is clearly displayed nearby. In the case of a fire, cut electrical power before dousing the flame. Familiarize yourself with the correct range for your extinguisher before use. Take care not to use the extinguisher too close to the flame, as its high pressure can produce blowback.



## 2.3 Laser Safety Instructions

When used as instructed, this machine comprises a Class 1 laser system safe for users and bystanders. However, the invisible engraving laser, the laser tube, and its electrical components remain **EXTREMELY** dangerous. Used or modified without care, they can cause serious property damage and personal injury including but not limited to the following:



- The laser will easily burn nearby combustible materials
- Some working materials may produce radiation or harmful gases during processing
- Direct exposure to the laser will cause bodily harm including serious burns and irreparable eye damage

As such,

- **DO NOT** modify or disassemble the laser and do not use the laser if it has been modified or disassembled by anyone except trained and skilled professionals. Do not modify or disable this device's provided safety features. Dangerous radiation exposure and other injuries may result from the use of adjusted, modified, or otherwise incompatible equipment.
- **NEVER** leave any part of the machine open during operation. Never interfere with the laser beam, do not place any part of your body in any part of the laser path during operation, and never attempt to view the laser directly with the naked eye. When risking exposure to the laser beam, take measures to protect yourself from potentially reflected laser beams, including the use of personal protective equipment such as protective eyewear specially designed to filter the specific wavelength of your engraver's laser with an optical density (OD) of 5+.
- **DO NOT** stare or allow others to stare continuously at the laser beam during operation even when the cover is closed and/or wearing protective eyewear. Exercise caution with the red dot positioning light as well, as its direct beam is a Class 2 laser in its own right.
- **ONLY** use this engraver if its automatic shutoffs are working properly. When you first set up this engraver, and if you subsequently notice any problems, test them (see below) before undertaking any other work. Do not continue use if the shutoffs do not occur. Turn off the device and contact customer service or your repair service. Never disable these shutoffs.
- **DO NOT**, under **ANY** circumstances, use this laser engraver if the water cooling system is not working correctly. Always activate the water cooling system and visually confirm that water is flowing through the entire system before turning on the laser tube. If using the provided water pump, ensure that it is placed in a tank full of cool or tepid distilled water. Do not use ice water or allow the water to become hotter than 100°F (38°C). For best results, keep it between 60–70°F (15–21°C). Replace heated water or add sealed bottles of frozen water to cool it while never allowing the system to run without water or allowing the water to become colder than 50°F (10°C). Immediately stop use if the water cooling system malfunctions.
- **DO NOT** use generic coolant or antifreeze in your cooling water, as they may leave corrosive residues and solidify inside your hoses and piping, causing malfunctions and even explosions. Use custom laser-safe formulations or use and store your engraver in a climate-controlled area.
- **DO NOT** leave potentially combustible, flammable, explosive, or corrosive materials nearby where they could be exposed to the direct or reflected laser beam.
- **DO NOT** use or leave sensitive EMI equipment nearby. Ensure the area around the laser is free of strong electromagnetic interference during any use.
- **ONLY** use this machine for working the materials described in the Material Safety section of this manual. The laser settings and engraving process must be properly adjusted for specific materials.
- Ensure the area is kept free of other airborne pollutants, as these might pose a similar risk of reflection, combustion, etc.

## 2.4 Electrical Safety Instructions

- **ONLY** use this device with a compatible and stable power supply with less than 5% fluctuation in its voltage.
- **DO NOT** connect other devices to the same fuse, as the laser system will require its full amperage. Do not use standard extension cords or power strips. Use only surge protectors rated over 2000J.
- **ONLY** turn on the power to this device when it is well-grounded, either via a firm connection to a 3-prong outlet or via a dedicated grounding cable firmly connected to the ground pole on the machine's rear. Do not use an ungrounded 3 to 2 prong adapter. The device's grounding should be checked regularly for any damage to the line or loose connections.
- The area around this laser engraving device should be kept dry, well ventilated, and environmentally controlled to keep the ambient temperature between 40–95°F (5–35°C). For best results, keep the temperature at 75°F (25°C) or below. The ambient humidity should not exceed 70%.
- Do not handle the water pump (or the water in which it is submerged) while it is connected to its power supply. Place it in water before connecting it to power and disconnect it from power before removing it.
- Adjustment, maintenance, and repair of the electrical components of this device must be made **ONLY** by trained and skilled professionals to avoid fires and other malfunctions, including potential radiation exposure from damage to the laser components. Because specialized techniques are required to test the electrical components of this marking system, it is recommended such testing only be done by the manufacturer, seller, or repair service.
- Unless otherwise specified, **ONLY** undertake adjustment, maintenance, and repair of the device when it is turned off, disconnected from its power supply, and fully cooled.



## 2.5 Material Safety Instructions

- Users of this laser engraving machine are responsible for confirming that processed materials can withstand the heat of the laser and will not produce any emissions or byproducts either harmful to people nearby or in violation of local or national laws or regulations. In particular, do not use this device to process polyvinyl chloride (PVC), teflon, or other halogen-containing materials under any circumstances.
- **DO NOT** use high power settings at very low speeds when engraving highly flammable materials. Instead, use more repetitions of your design at low power settings to achieve a similar effect.
- Users of this laser engraver are responsible for ensuring that every person present during operation has sufficient PPE to avoid injury from the emissions and byproducts of the materials being processed. In addition to the protective laser eyewear described above, this may require goggles, masks or respirators, gloves, and other protective outer clothing.
- **DO NOT** ever use this laser engraver under any circumstances if the exhaust system is not working properly. Always ensure that the exhaust system can remove the dust and gas produced by the engraving process in accordance with all applicable local and national laws and regulations. Immediately stop use and clean or repair the system if the exhaust fan or vent pipe begins making more noise than usual or otherwise malfunctions. **ONLY** use this engraver when its air assist is working properly.
- Users must exercise special caution when working with conductive materials as the buildup of their dust and ambient particles may damage electrical components, cause short circuits, or produce other effects, including reflected laser radiation.



This machine can be safely used with the following materials:

### **Plastics**

- Acrylonitrile Butadiene Styrene (ABS)
- Nylon (Polyamide, PA, etc.)
- Polyethylene (PE)
- High-Density Polyethylene (HDPE, PEHD, etc.)
- Biaxially-Oriented Polyethylene Terephthalate (BoPET, Mylar, Polyester, etc.)
- Polyethylene Terephthalate Glycol (PETG, PET-G, etc.)
- Polyimide (PI, Kapton, etc.)
- Polymethyl Methacrylate (PMMA, Acrylic, Plexiglass, Lucite, etc.)
- Polyoxymethylene (POM, Acetal, Delrin, etc.)
- Polypropylene (PP, etc.)
- Styrene

### **Other**

- Cardboard
- Ceramics, including Dishes, Tile, etc.
- Glass
- Leather
- Paper & Paperboard
- Rubber
- Stone, including Marble, Granite, etc.
- Textiles, including Cotton, Suede, Felt, Hemp, etc.
- Wood, including Cork, MDF, Plywood, Balsa, Birch, Cherry, Oak, Poplar, etc.

See §4.3 for the recommended parameters for the most commonly engraved materials.

This machine **CANNOT** be used with the following materials or with any materials which include them:

- Artificial Leather containing Hexavalent Chromium (Cr[VI]), due to its toxic fumes
- Astatine, due to its toxic fumes
- Beryllium Oxide, due to its toxic fumes
- Bromine, due to its toxic fumes
- Chlorine, including Polyvinyl Butyral (PVB) and Polyvinyl Chloride (PVC, Vinyl, Cintra, etc.), due to its toxic fumes
- Fluorine, including Polytetrafluoroethylene (Teflon, PTFE, etc.), due to its toxic fumes
- Iodine, due to its toxic fumes
- Metals, due to their conductivity and reflectivity
- Phenolic Resins, including various forms of Epoxy, due to their toxic fumes
- Polycarbonate (PC, Lexan, etc.), due to its toxic fumes

For all other materials, if you are unsure about its safety or laserability with this device, seek out its material safety data sheet (MSDS). Pay especial attention to information about safety, toxicity, corrosiveness, reflectivity, and reaction(s) to high heat. Alternatively, contact our support department for further guidance.

## **3. Installation**

### **3.1 Installation Overview**

A complete working system consists of the laser engraving machine, its integrated air assist and exhaust system, a water tank (not included) with a pump (included), and a USB cable connected to a control computer with the enclosed engraving software. Users can also configure other additional accessories (such as an industrial water chiller or rotary axis) to suit their needs.



Use only the hardware, wiring, and power sources that came with or are compatible with this device. Installing equipment that your device is not designed to work with can lead to poor performance, shortened service time, increased maintenance costs, property damage, and personal injury.

Please note the specific requirements of your system's installation. Every customer must understand these notes before installation to execute a proper setup and achieve safe laser performance. If you have any installation questions or problems, contact our technicians and customer support team.

Any auxiliary equipment must be adjusted to the base machine. Queries may be directed to the dealer or manufacturer of such equipment.

### **3.2 Location Selection**

Before you install your engraver, select an appropriate location for its use.

Be sure that it meets all of the requirements discussed in the Safety Information above. The location should be stable, level, dry, and climate-controlled to ensure an ambient temperature of 40–95°F (5–35°C) and an ambient humidity of under 70%. In particular, the temperature and humidity together should not be close to the dew point. It is also advisable to use a windowless room or to use blinds and/or curtains to avoid exposure to the potential additional heat of direct sunlight. The location should be free of dust and other airborne pollutants and well ventilated enough to process any fumes produced by the engraving process in accordance with all applicable laws and regulations. Depending on the materials to be processed, this may require the construction of a dedicated ventilation system. It should be kept away from children, sensitive EMI devices, and combustible, flammable, explosive, or corrosive materials. Remove any items that might block the side vents. The power cord should be plugged into a compatible and stable power source via a grounded 3-prong outlet. No other item should be drawing current from the same fuse. There should be firefighting equipment nearby, and the local fire department's phone number should be clearly displayed.

It is highly recommended to have an extra work table nearby in order to avoid placing objects on or directly adjacent to the machine, which could become a fire or laser hazard.

### **3.3 Unpacking Your Engraver**

Your engraver arrives in a box with its accessories (including this manual) packaged on top of your engraving device. Check that you have received all of the following: a power cord, a USB cable, a USB flash drive with engraving software included, a water pump and water piping, an exhaust pipe with a hose clamp, a tube of silicone sealant, an acrylic focusing tool, a laser key, a ceramic testing resistor and its separate instructions, a roll of double-sided tape, and this manual. Carefully remove any foam packaging material and nylon ties from the laser tube and axes. You may keep the packaging in case of a future return but, if you do dispose of it or any accessories, be sure to do so in compliance with applicable waste disposal regulations.

### 3.4 Water Cooling Installation



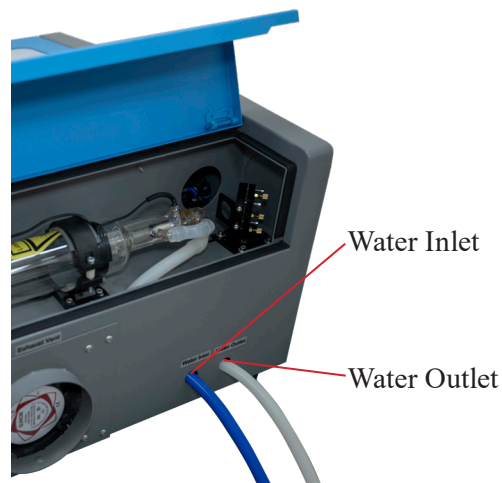
The provided water pump is essential to your engraver's performance and longevity. When this laser works without a properly maintained cooling system, its glass tube **WILL** explode from excess heat.



**NEVER** touch or adjust your engraver's water supply while the pump is connected to power.

To install your pump, fill a dedicated tank with distilled water. The tank should always hold at least 2 gallons (7.5 L) of water. Using deionized or tap water will gradually degrade the quality of your engraver and may even cause dangerous mineral buildup in the cooling system. **NEVER** use generic antifreeze for the same reason. Use custom laser-safe formulations or use and store your engraver in a climate-controlled area.

Connect the blue hose that came preinstalled on your engraver directly to your pump and completely submerge the pump in your water tank. Place the other tube into the tank in such a way that the returning water flows into the tank without splashing or other problems.



Connect the water pump to its power supply. For best results, use a power outlet on a separate fuse from the engraver itself. If no such outlet is available, the pump can also be plugged into a dedicated socket located on the back of the engraver. Once the plug is plugged in, water should begin to run through your machine and back into your tank. **ALWAYS** obtain visual confirmation that the water is flowing through the laser tube before starting your laser.

**NEVER** allow the water in the tank to become too hot to cool the laser. Heat damage can occur quickly and severely shorten the life of the laser tube. Periodically check the water's temperature on the built-in digital display. For best results, keep it between 60–70°F (15–21°C). If the water begins to come near 100°F (38°C), replace it with cooler water. Either replace it in stages or turn off the laser during this process: never allow the laser to operate without a constant flow of cooling water. It is also possible to add sealed bottles of frozen water to your tank to keep the water cool but never allow the water to become ice cold itself, as this could shatter the heated glass CO<sub>2</sub> tube as well.

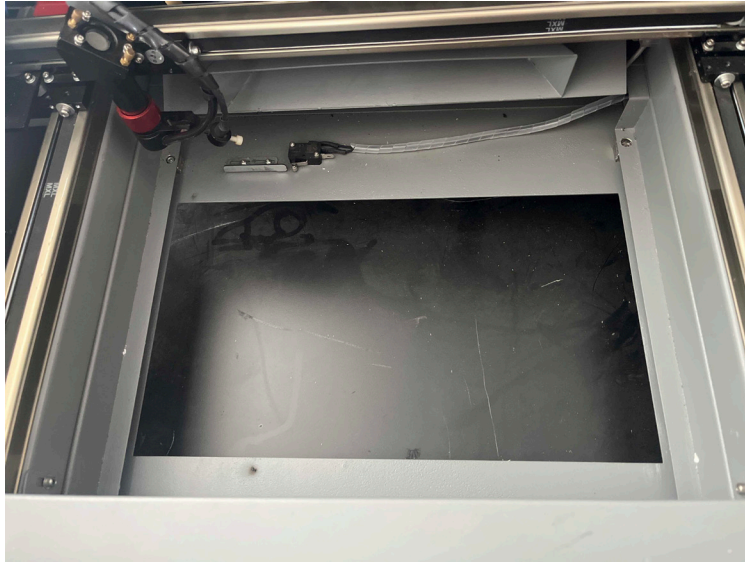
As an alternative to manually adjusting the water in your tank, you may also use an industrial water chiller to supply temperature-controlled water to your machine. We recommend the CW-3000 9L chiller (not included). If using it with this engraver, follow its separate manual and plug it into an outlet on a separate fuse from the engraver itself.



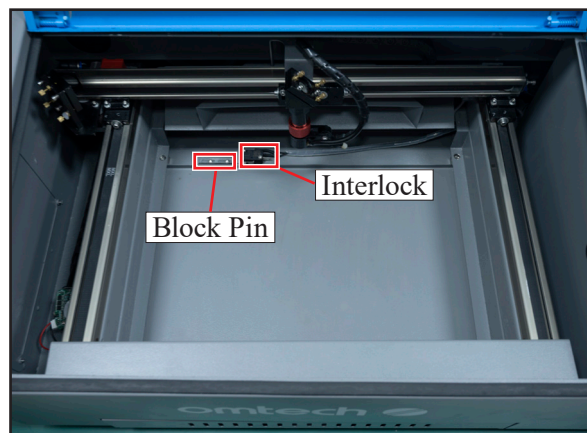
### 3.5 Rotary Axis Installation

Optionally, you can use a rotary axis for your engraver.

1. Remove the honeycomb workbed and the debris tray for more space.



2. Place a sacrificial base, preferably a non-reflective steel sheet on the work area.
3. Place your rotary axis on the sacrificial base.
4. Pin the interlock in the debris tray down by pushing the in-built block pin right to activate the interlock.



5. Open the gate of the control panel.
6. Pull off the Y-axis cable from the board and insert the plug of your rotary axis.



### 3.6 Exhaust System Installation

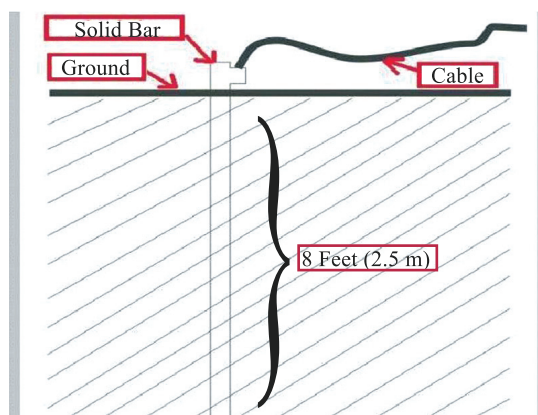
Install the provided exhaust pipe onto the fan, as shown below. The pipe can be expanded to a full length of about 5 feet (1.5 m). The other end of the pipe should be connected to a dedicated purifier or (if the fumes are not hazardous and meet local and national air safety standards) placed out a window.



**NEVER** operate the machine in a closed room and **NEVER** operate the laser if the vents are not purifying or removing the fumes produced by the target material. Research materials before use and never operate the laser on any (such as PVC, teflon, or other halogen-containing substances) that can produce corrosive, hazardous, or even deadly fumes.

### 3.7 Electrical Grounding

This device employs a powerful laser. As discussed in the Safety Information above, it is extremely high voltage and potentially dangerous, so users must securely ground it to avoid the buildup of static electricity. Using a standard 3-prong outlet will provide sufficient grounding. If you do not have access to a 3-prong outlet, you **MUST** use the grounding cable and ensure its proper connection. The far end of the cable should be securely connected to a single metal rod driven at least 8 feet (2.5 m) deep or to two separate metal rods driven at least 4 feet (1.2 m) deep into soil located at least 5 feet (1.5 m) from the machine. The resistance along the line should be no greater than 5Ω.



Poor grounding **WILL** cause equipment failure and create a serious electrical shock hazard. The manufacturer and/or seller bear(s) no responsibility and assume(s) no liability for any damage, accidents, or injuries caused by bad grounding connections.

### 3.8 Main Power Connection

Confirm that the labeling beside the connection socket on the machine matches your power supply. Connect one end of the main cable to the connection socket and the other end to a grounded outlet. Under **NO** circumstances should you switch on the device if the voltages do not correspond.

Fluctuation along the line should be less than 5%. If this is exceeded, the fuses will blow. They are located in the connection socket and are accessible from the exterior. Similarly, do not connect this device to standard extension cords or power strips. Connect it directly to a grounded outlet or use a surge protector rated over 2000J.

### 3.9 Air Assist Inspection

Your air assist should arrive preinstalled and correctly wired. Confirm that pressurized air begins to blow from the laser head when the engraver is connected to power, its emergency stop released, and its laser key turned on.

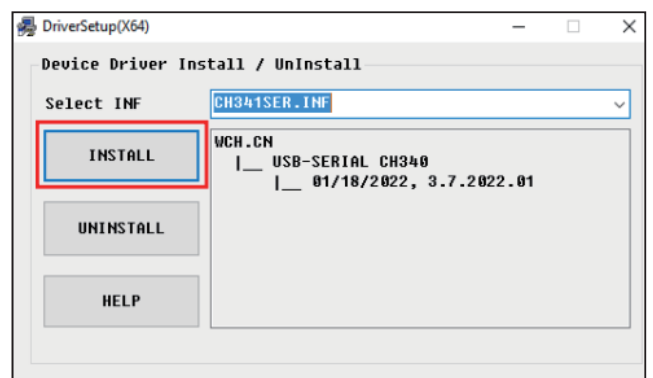


If any tubing or wiring needs to be adjusted or reconnected, turn off the machine and disconnect it from power before making any such adjustment.

### 3.10 Control Computer Setup

The control computer should be connected using the provided USB cable via the port marked “USB Cable to PC”. If you choose to use a longer cable, do not use one longer than 15 feet (4.5 m) to avoid possible interference on the line.

Access the USB flash drive provided with your engraver’s accessories pack. Extract and install the version of the CH341 driver that matches your control computer’s operating system.



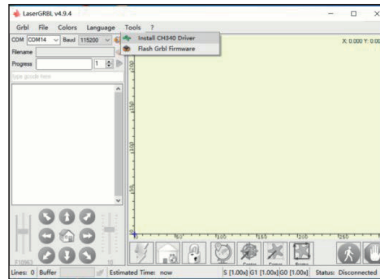
Extract and install LaserGRBL from the same flash drive or download the newest edition from its official website [lasergrbl.com](http://lasergrbl.com). Alternatively, this engraver is compatible with most 3rd party engraving software, including LightBurn.

## LaserGRBL Configuration

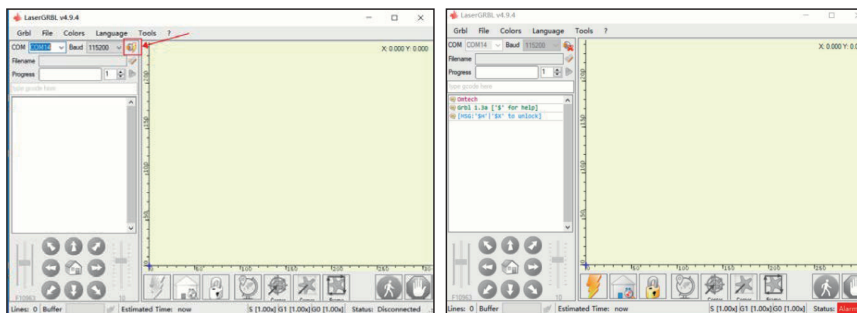


The following steps and parameter settings apply only to LaserGRBL users. If you have installed LaserGRBL but choose to use Lightburn, remember to restore the parameters you've customized for LaserGRBL to their default values.

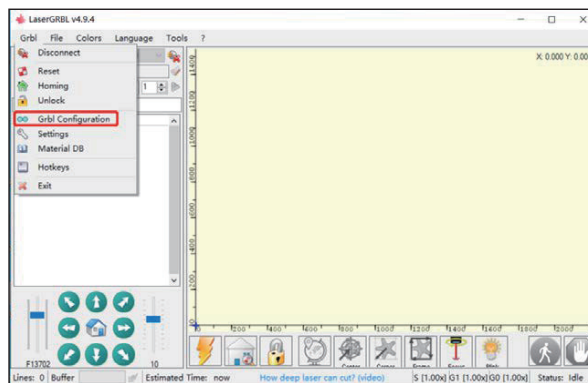
Open the LaserGRBL software on your computer. Select "Tools" from the toolbar at the top and then the "Install CH340 Driver" option.



Once the driver is installed, choose the COM port and set the baud rate to 115200. Next, click "Connect".



After your engraver has successfully connected, click on "Grb1" and select "Grb1 Configuration".

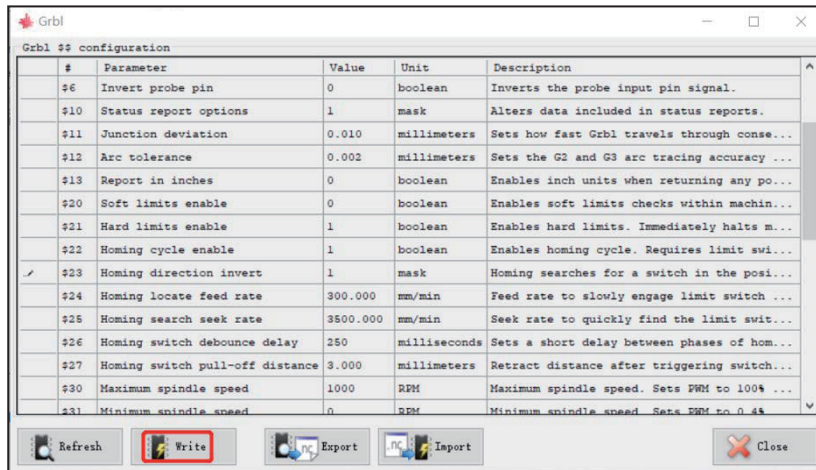


In the configuration menu, change Step Direction Invert (Item #3) from 1 to 3 and Homing Direction Invert (Item #23) from 3 to 1.

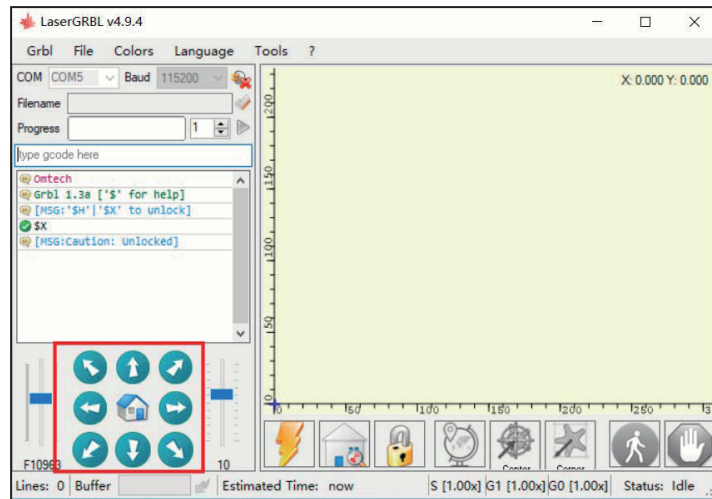
#	Parameter	Value	This	Description
90	Step pulse time	10	microseconds	Sets time length per step. Minimum 5usec.
91	Step idle delay	25	milliseconds	Sets a short hold delay when stopping to...
92	Step pulse invert	0	mask	Inverts the step signal. Set axis bit to...
93	Step direction invert	1	mask	Inverts the direction signal. Set axis b...
94	Invert step enable pin	0	boolean	Inverts the stepper driver enable pin vi...
95	Invert limit pins	0	boolean	Inverts the all of the limit input pins.
96	Invert probe pin	0	boolean	Inverts the probe input pin signal.
97	Status report options	1	mask	Alters data included in status reports.
98	Junction deviation	0.010	millimeters	Sets how fast Gch1 travels through conse...
99	Arc tolerance	0.002	millimeters	Sets the G2 and G3 arc tracing accuracy ...
100	Report in inches	0	boolean	Enables inch units when returning any po...
101	Soft limits enable	0	boolean	Enables soft limits checks within machin...
102	Hard limits enable	1	boolean	Enables hard limits. Immediately halts m...
103	Homing cycle enable	1	boolean	Enables homing cycle. Requires limit svi...
104	Homing direction invert	3	mask	Homing searches for a switch in the post...

#	Parameter	Value	This	Description
105	Invert probe pin	0	boolean	Inverts the probe input pin signal.
106	Status report options	1	mask	Alters data included in status reports.
107	Junction deviation	0.010	millimeters	Sets how fast Gch1 travels through conse...
108	Arc tolerance	0.002	millimeters	Sets the G2 and G3 arc tracing accuracy ...
109	Report in inches	0	boolean	Enables inch units when returning any po...
110	Soft limits enable	0	boolean	Enables soft limits checks within machin...
111	Hard limits enable	1	boolean	Enables hard limits. Immediately halts m...
112	Homing cycle enable	1	boolean	Enables homing cycle. Requires limit svi...
113	Homing direction invert	1	mask	Homing searches for a switch in the post...
114	Homing locate feed rate	300.000	mm/min	Feed rate to slowly engage limit switch ...
115	Homing search seek rate	3500.000	mm/min	Seek rate to quickly find the limit swit...
116	Homing switch debounce delay	250	milliseconds	Sets a short delay between phases of hom...
117	Homing switch pull-off distance	3.000	millimeters	Retract distance after triggering switch...
118	Maximum spindle speed	1000	RPM	Maximum spindle speed. Sets RPM to 100% ...
119	Maximum spindle speed	0	RPM	Maximum spindle speed. Sets RPM to 0-14 ...

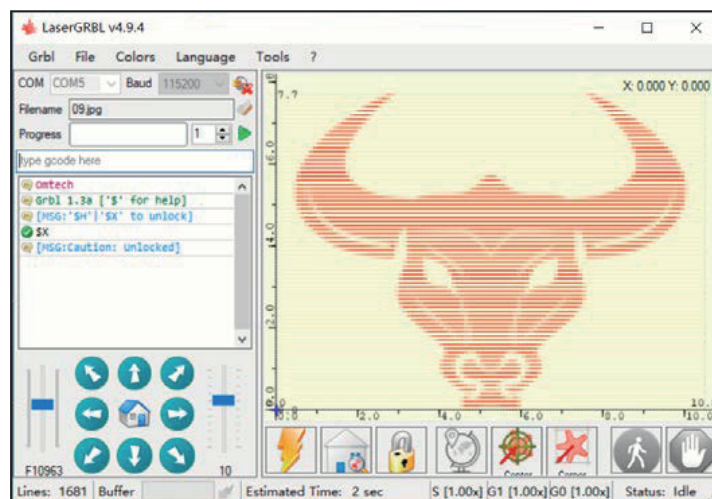
Click “Write” to save the changes you’ve made and then close the menu.



To enable the move menu, type the command `$X` into the GCode field and press Enter.



The software should now work with your engraver. Familiarize yourself with the software’s image design features and laser control settings before using it to operate your device.

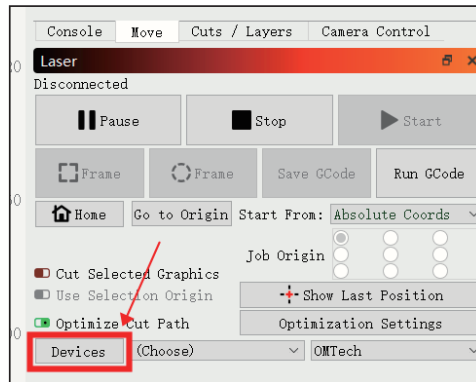


## LightBurn Configuration

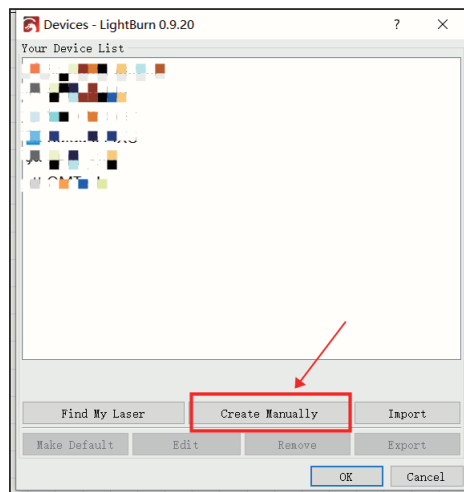


The following steps and parameter settings apply only to Lightburn users. If you have installed Lightburn but choose to use LaserGRBL, remember to restore the parameters you've customized for Lightburn to their default values.

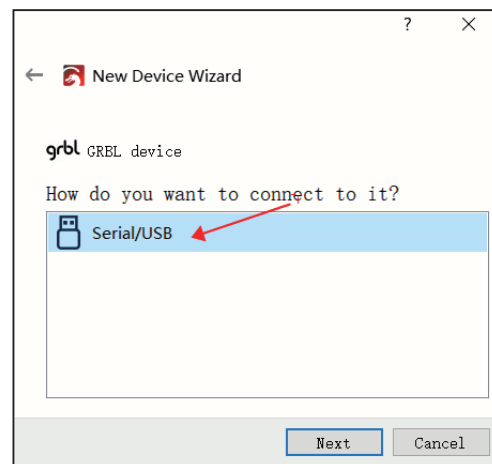
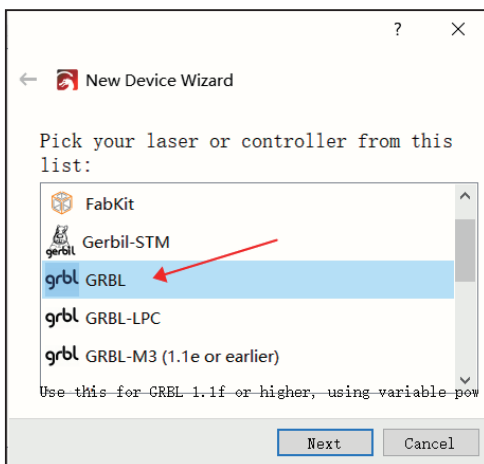
After you have installed the CH341 driver, open your LightBurn software and select “Devices”.



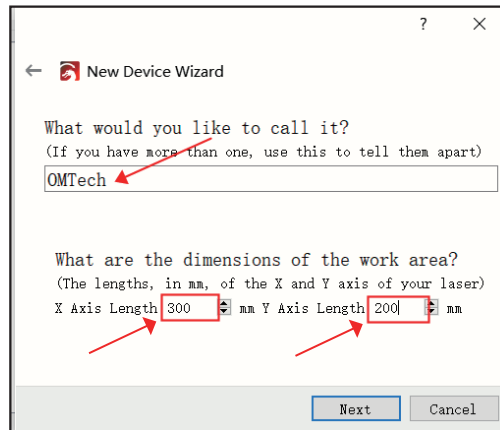
Click “Create Manually”.



Select “GRBL” and click “Next”. Select “Serial/USB” and click “Next”.



Name the laser and set its X-axis length to 300mm and its Y-axis length to 200mm.



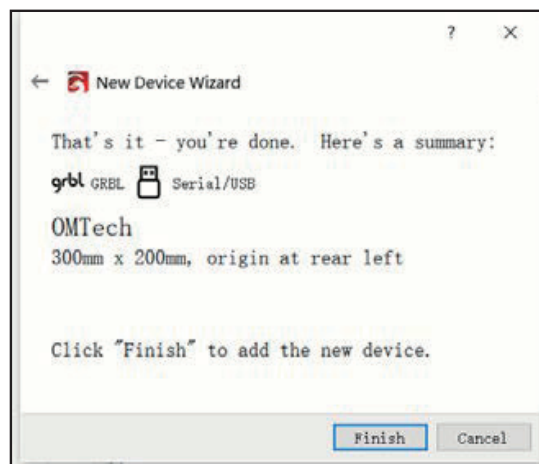
Choose a corner to use as the machine's origin point and click "Next".



Choosing an origin different from your design files may produce mirrored work or cause the laser to fire off your material, producing dangerous reflections.



Check whether your setup is correct and then click "Finish". The software should now work with your engraver. Familiarize yourself with the software's image design features and laser control settings before using it to operate your device.



## Other Programs

For other engraving software, follow its separate manual to configure the software to work with your new engraver and contact customer service if you run into any trouble on the way.

## 3.11 Initial Testing

### Emergency Shutoff

Because of the risk of fire and other hazards during engraving, this engraver includes a large and easy-to-reach emergency stop button on the control panel. Press it down to stop the laser tube instantly.



When your engraver arrives, its e-stop should be pressed down and must be released to allow the laser to function. You should test that it works properly before conducting **ANY** other work with your machine. Start the water cooling system, place a piece of laserable scrap material on the workbed, close the cover, and fire the laser. Hit the emergency stop button and observe whether the laser stops instantly. If the laser continues to fire, the emergency stop is not working and must be replaced before the engraver can be used. Turn off the machine and contact customer service.

### Cover Shutoff (Interlock)

Because of the risk of blindness, burns, and other injury from direct exposure to the invisible engraving beam, this device also shuts off the laser automatically when the protective cover is raised during operation.

After ensuring that the emergency stop button works, you should also test that the cover shutoff works properly before conducting any other work on your machine. Start the water cooling system, place a piece of laserable scrap material on the workbed, close the cover, and fire the laser. Release the button. Taking care not to expose yourself to seeing or being hit by any possible reflected laser light, open the cover as little as possible and attempt to fire the laser again. If the laser fires, the automatic shutoff is not working and must be repaired before the engraver can be used. Turn off the machine and contact customer service.

### Laser Path Calibration

Although our factory calibrates your entire system during assembly, it is possible for the laser tube, the focus lens, and/or one or more of the mirrors to be jostled out of alignment during shipment. As such, it is recommended that you perform an optical alignment test as part of setting up your machine. Be especially mindful **NOT** to look at the laser directly during this initial process. See the Maintenance section below for step-by-step guidance.



# 4. Operation

## 4.1 Operation Overview



Operate this laser marking machine only in accordance with all the instructions provided in this manual. Failure to follow the proper guidelines detailed here can result in property damage and personal injury.

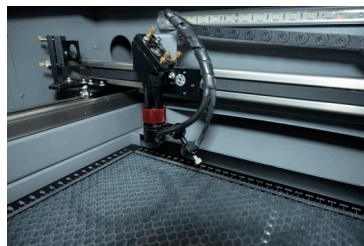
Before beginning to use the machine, make sure that you have read this entire manual (particularly the Safety Information above) and any and all warnings provided on the machine itself.

If you're using LightBurn software, please refer to your separate LightBurn manual (not included) for specific operation instructions.

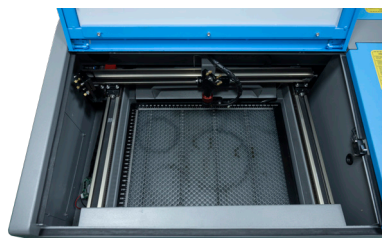
## 4.2 General Operation Instructions

- Step 1.** Create a design that you'd like to engrave. You can do this using any graphics program, saving or converting the file to a format compatible with the engraver. See the full list of acceptable file types in the Technical Specifications section above.
- Step 2.** Check that your water tank is full of clean and cool but not cold distilled water. Replace the water if it is not clean or cool. Add more water if it is not completely covering the water pump. Turn on the water pump by plugging it in or (if it's plugged into the engraver directly) by turning and pulling the emergency stop button. Visually confirm that the water is flowing through the whole system either by opening the top rear door to look at the laser tube itself or by observing that water is entering the machine and returning to the tank through the outlet tube. If the laser tube is examined directly, remember to close its access door before continuing. Add more distilled water if the pump is no longer well covered after filling the engraver's water tubing.
- Step 3.** Turn on your fume extractor or ventilation system, if any. (The engraver's own exhaust fan will turn on with the machine.)
- Step 4.** Open the engraver's cover and place a dry and clean piece of your material on the workbed. If working with a new material, first check that it can withstand the heat of the laser and will not release harmful fumes when processed.

Confirm that the distance from the laser head's focus lens to the top of your material exactly matches the lens's focal length (see §1.4).



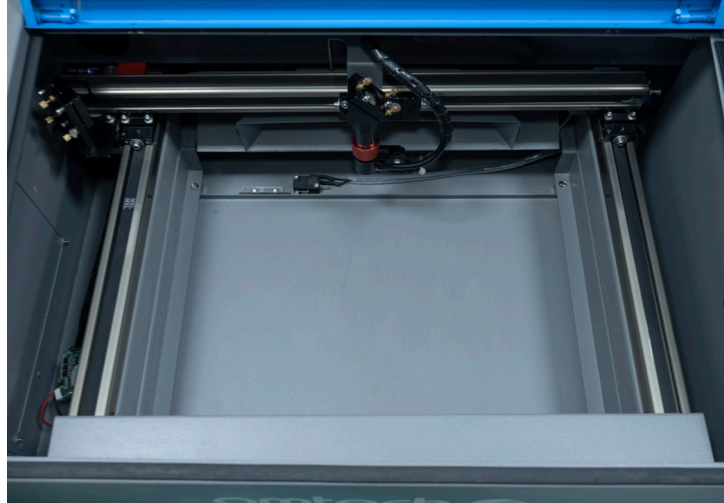
If the distance is too long, you can either move the manual focusing knob down, use a thicker piece of material, or find a safe way to elevate your material to the correct distance. If the distance is too short, move the manual focusing knob up or remove the honeycomb workbed.



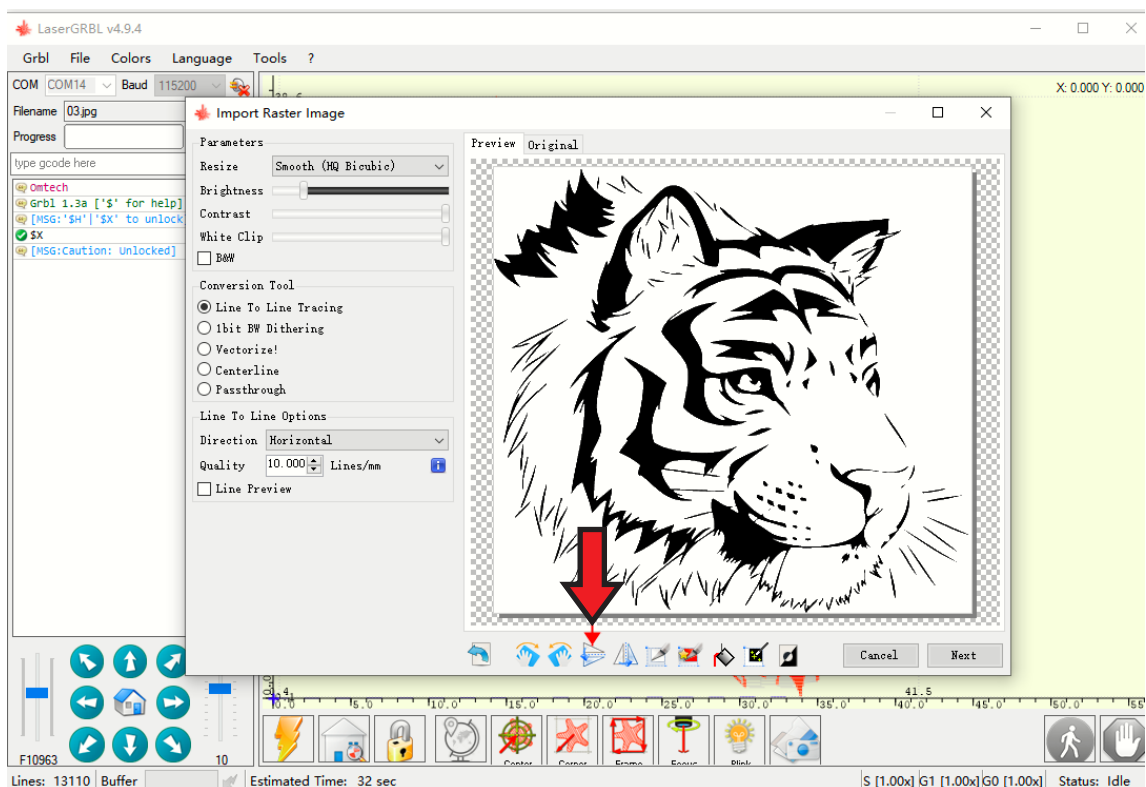
Place a sacrificial base first, preferably a non-reflective steel sheet. Place your laserable material under the laser head and on top of the base, adjusting the base's thickness to make sure the upper surface of the laserable material is at the correct height.



Do not use an aluminium sheet or other similarly reflective materials as the sacrificial base, as they **WILL** cause the laser beam to go astray as the laser hits it.

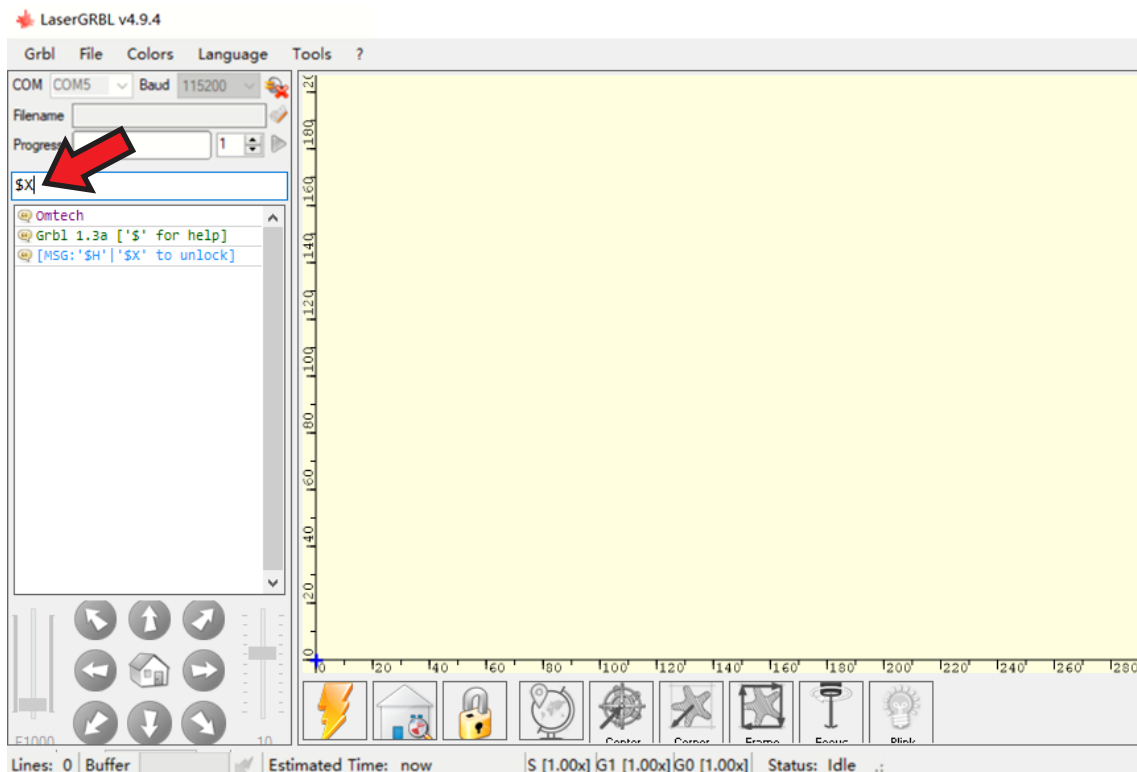


**Step 5.** Close the cover. Turn on your control computer, open LaserGRBL or another engraving program, and load your design. You will generally need to click the rotate button shown below, as the engraving forms a mirror image of the displayed design.

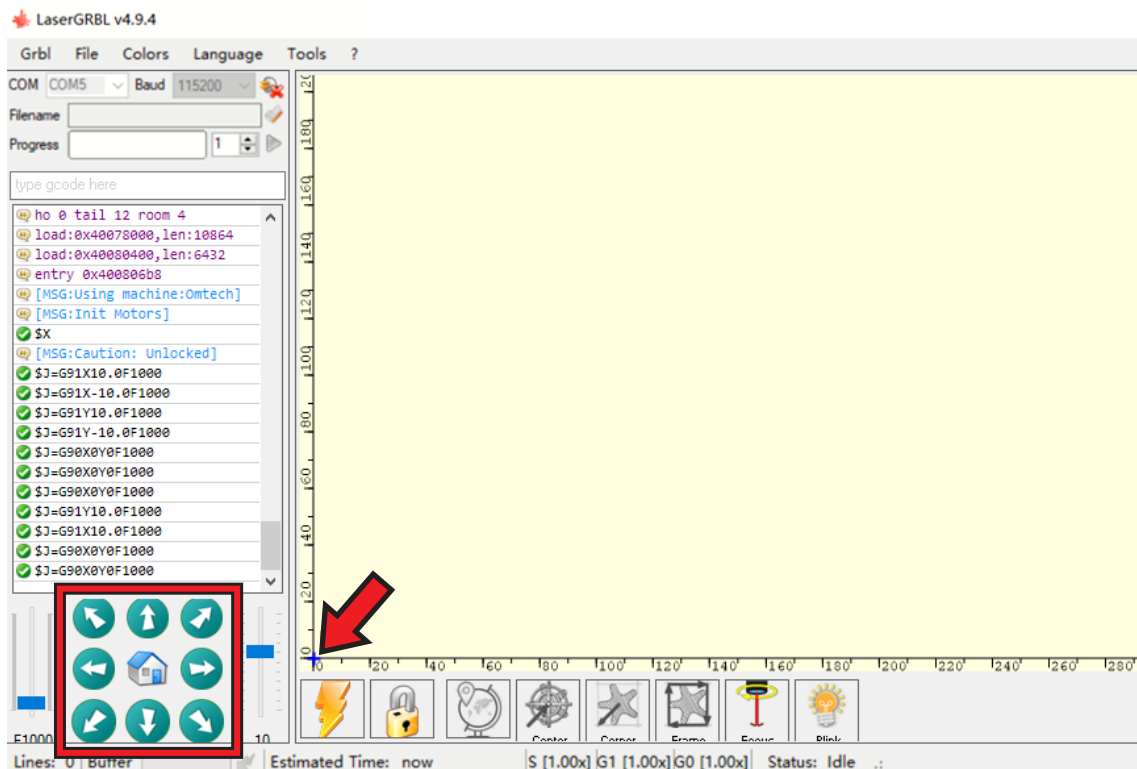


**Step 6.** Release the emergency stop button to start your engraving machine. Turn on the laser tube by inserting and turning your laser key. To reduce the risk of electric shock, once the laser tube is on, try to touch the engraver with only one hand at a time. Check the built-in digital display to ensure that the water's temperature is at an acceptable level.

**Step 7.** Prepare your design's location. In LaserGRBL, type "\$X" into the GCode field and press Enter to enable repositioning.



The origin is shown as the center of the cross formed by the X and Y axes. Use the arrows to adjust the placement of your design to match your material's location.



**Step 8.** Customize your design's contrast and engraving depth by adjusting the speed, power, and other parameters in your engraving software.

If you see the power setting in milliamperes, use the following conversion chart to find the appropriate power setting:

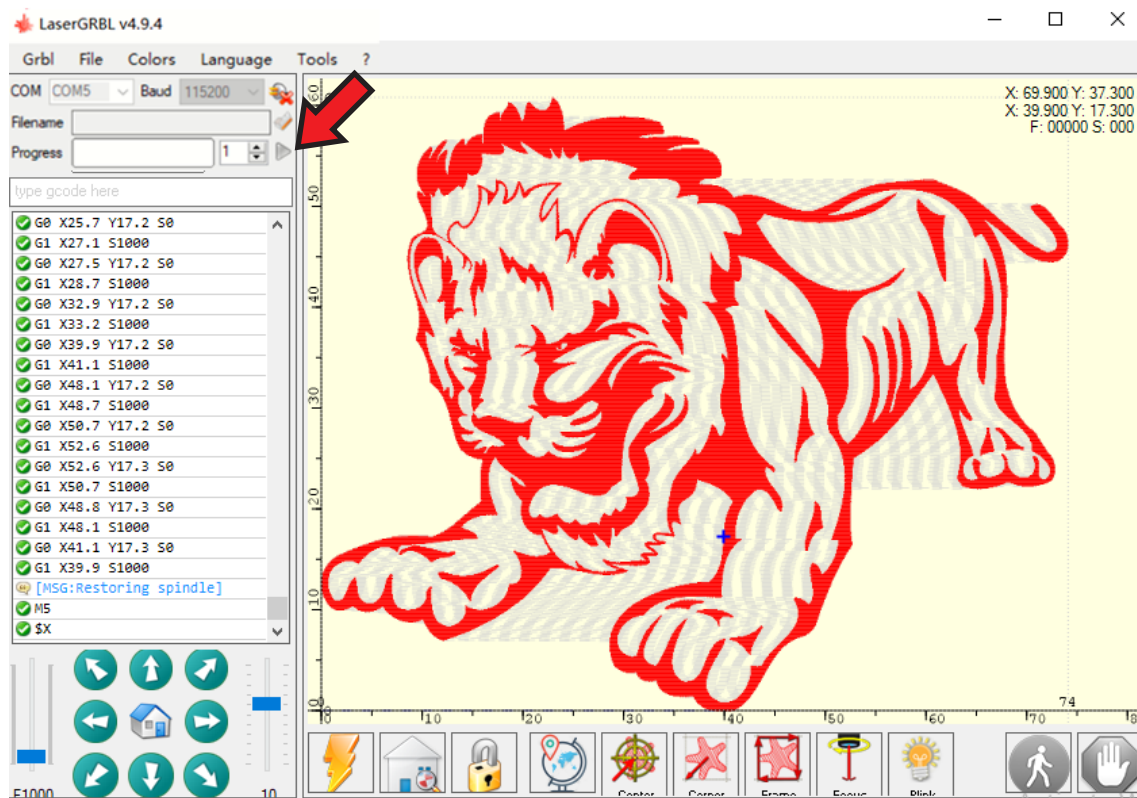
Power	10%	15%	20%	25%	30%	35%	40%	45%	50%	55%	60%	65%	70%	80%+
Current	7 mA	8 mA	9 mA	10 mA	12 mA	13 mA	15 mA	17 mA	18 mA	20 mA	21 mA	22 mA	23 mA	24 mA

It is **NOT** recommended to use the laser tube at full capacity, especially for extended periods. The recommended maximum power setting is 70%, as prolonged use above that amount will shorten your laser's service life. To increase the engraving depth, increase the amount of energy per unit area by increasing laser power, increasing loop count, or slowing down the speed parameter. Engraving too deep, however, reduces image quality, especially for coated materials.

When working with new materials, remember you should always start on the low end of likely settings. If the effect is not yet strong enough, you can always rerun the design loop several times or rerun it with more powerful settings until you create the desired effect. Avoid using high power settings at very low speeds when engraving highly flammable materials.

Resolution should usually be set to 500 dots per inch. Reducing your image resolution can be helpful in some cases, reducing flaming and increasing the energy of the pulse in a way that improves the quality of the resultant image in some materials such as some plastics.

**Step 9.** Start engraving your design. In LaserGRBL, do this by clicking the green ► arrow. Again, do not stare continuously at the laser even through the protective polycarbonate window. Watch for possible issues like sparks or fires, however, and be prepared to quickly extinguish a fire if necessary.



**Step 10.** Once the laser has stopped, examine the quality of your first run and adjust the laser parameters in your software as necessary to create the desired effect.

During repetitive engraving and cutting, periodically check your temperature gauge to maintain a water temperature below 100°F (38°C). If this temperature is reached, stop work and allow your device to cool before further use.

**Step 11.** When you have finished engraving, close your engraving software and then turn off your machine in the following order: the laser power supply (by removing your laser key from the control panel), the control system (by pushing down the emergency power button), any ventilation device, and—after providing some time for your tube to cool—the water cooling system.

**Step 12.** Fully clean the workbed and main bay. For best results, disconnect your laser engraver from its power supply between uses. Unplug it or turn off its intermediary surge protector.

## 4.3 Instructions for Specific Materials

The following instructions are suggestions to help speed safe work with a range of materials. The user should research the specific safety and engraving requirements of their specific material to avoid the risk of fire, hazardous dust, corrosive and poisonous fumes, and other potential problems. Once the product is known to be safe or appropriate protective equipment has been set up, it can be helpful to engrave a test matrix of small boxes produced at various speed and power settings to discover the ideal settings for your design. Alternatively, start with low power and fast speed settings and rerun your design as many times as needed, using progressively greater laser intensity.

### Ceramics

When engraving on ceramics, generally use moderate to high power. Using more loops rather than higher power and lower speed can help avoid cracking the material during work. Be mindful of the health risk posed by dust generated from ceramic engraving, especially for repetitive industrial applications. Depending on the material and the amount of work, a fan or even full ventilation system may be required to address the problem. Similarly, operators and others in the work area may need to use breathing PPE such as masks and respirators.

### Glass

When engraving glass, generally use high power and low speed. As with ceramics, it can be helpful to run more loops at lower settings to avoid cracks. Care must be taken when engraving fiberglass and carbon fiber to avoid combinations of settings that produce a laser intensity great enough to damage the structural integrity of its component fibers, producing blurry marking. PPE should be worn to avoid exposure of the eyes, nose, mouth, and skin to the dust produced by working with either material, especially for repetitive industrial applications. Clothing worn while working with fiberglass should be washed separately afterward.

### Leather

When engraving leather products, generally use low to moderate power at high speed. Natural leather should be engraved slightly slower and at slightly higher power than artificial leather. Be especially attentive to the possibility of fire, as well as the dust produced in repetitive applications.

### Metal

CO<sub>2</sub> laser engravers should not be used for marking, engraving, or cutting metal. They are best suited for working coatings applied to a metal base, and care must be taken not to attempt work on the underlying metal itself. A variety of coatings specialized for CO<sub>2</sub> engraving are available, and the user should follow the instructions provided as the parameters vary from product to product and metal to metal. Generally, work on aluminum coatings should be done more quickly at lower power, and work on steel coatings can be done more slowly at higher power.

## **Paper and Cardboard**

When engraving various paper products, generally use low to moderate power and fast speed. Test samples from each batch as only small parameter differences can separate effects that are too light from those that burn through the substrate. As with leather, be especially attentive to the possibility of fire, as well as the dust produced in repetitive applications.

## **Plastics**

Plastics for engraving are available in many different colors and thicknesses and with many different coatings and surfaces. The majority of available plastics can be well engraved and cut with the laser. Plastics with a microporous surface seem to give the best result because less surface material needs to be removed. When engraving plastics, generally use low power and high-speed settings. Marking and engraving with too much power or at too low a speed can concentrate too much energy at the point of contact, causing the plastic to melt. Among other problems, this may produce poor engraving quality, noxious fumes, and even fires. High-resolution engraving can cause the same problem, so medium to low-resolution designs should be preferred for most plastics.

## **Rubber**

Rubber's inconsistent composition density causes slightly varying engraving depth. Testing various settings on sample pieces of your specific rubber is highly recommended for the best results. When engraving rubber, generally use a consistently high power setting and create your effects by varying the laser's speed. Microporous rubber materials require a significantly higher speed than standard rubber. Engraving any kind of rubber produces a considerable amount of dust and gas. Depending on the amount of work, breathing PPE and/or a full ventilation system may be required to address the problem.

## **Stone**

When engraving various kinds of stone, generally use moderate power and moderate to fast speed. As with ceramics and glass, be mindful of the dust created (especially for repetitive industrial applications) and take similar measures to ensure the safety of users and others in the work area.

## **Textiles**

When engraving textiles like cloth and fleece, generally use low power and fast speed. As with leather, be especially attentive to the possibility of fire and dust.

## **Wood**

As with rubber, there is a huge variety of woods and testing your specific material is essential to get the best results. In general, wood with consistent grain and coloring engraves more evenly. Knotted wood produces uneven effects, while resinous wood produces greater edge contrast. Some softwoods like balsa, cork, and pine engrave well (albeit with low contrast) at low or moderate power settings and high speed. Others like fir suffer from uneven fibers that usually produce a poor effect no matter what you do. Hardwoods like cherry and oak engrave well at high power settings and low speed. Manufactured wood products can vary from brand to brand, mostly based on their glue composition and abundance. MDF works well but creates dark edges when cut.

In addition to the risk of fire with any wood product, extra care must be taken with the fumes from the glue used in plywood and other manufactured woods. Some are too dangerous to work with at all, while others require careful ventilation and the use of breathing PPE for repetitive industrial applications. Wood toxicity should also be examined, as the dust from some natural woods, including oleander and yew, can cause nausea and cardiac problems in high enough amounts.

# **5. Maintenance**

## **5.1 Maintenance Overview**



The use of procedures other than those specified herein may result in hazardous laser radiation exposure.

Before any cleaning or maintenance work, always switch off the device and disconnect it from its power supply.

Always keep the system clean, as flammable debris in the working and exhaust areas constitutes a fire hazard.

**ONLY** allow trained and skilled professionals to modify or disassemble this device.

- Clean and cool water must be provided to the system at all times.
- The working table must be cleaned on a daily basis.
- The mirrors and the focus lens must be checked every day and cleaned if required.
- The exhaust system must be checked every week and cleaned if required.
- The beam alignment should be checked weekly.
- The wiring should be checked every week for loose connections.
- The guide rails should be cleaned and lubricated at least twice a month.
- The air assist must be checked every month and cleaned if required.
- The whole laser machine and its accessories must be checked overall every month and cleaned where required.

## **5.2 Regular Maintenance**

### **Cleaning the Water Cooling System**



**NEVER** touch or adjust your engraver's water supply while the pump is still connected to power.

The laser tube requires cool and clean distilled water to avoid overheating. Tepid water at room temperature or a little below is ideal. The laser tube requires at least 2 gallons (7.5 L) of cool and clean distilled water or other laser-safe coolant to avoid overheating. If the temperature of the water ever begins to come near 100°F (38°C), discontinue work until it has cooled or find a way to reduce its temperature without interrupting the supply of water to the laser tube. The water should never be allowed to become too cold either, which could also cause the glass laser tube to shatter during use. During winter or if ice is used to cool hot water, ensure the temperature never falls below 50°F (10°C).

More water should be added every few days to ensure evaporation does not cause the pump to become exposed during use.

### **Cleaning the Mirrors and Focus Lens**

Dust and engraving debris will accumulate on your mirror and focus lens, resulting in energy loss and damage. They should all be cleaned frequently, ideally daily or after each use.

The mirrors may be cleaned in place. Use a lens-cleaning tissue or cloth or a cotton swab with an acetone or alcohol cleaning solution. Take care not to touch the surface of the mirrors directly with your fingers. Sterile single-use rubber gloves are helpful for this purpose. To avoid scratching the mirrors' surface coating or misaligning the laser beam's path, swab each mirror as gently as possible. For best results, begin in the center and rotate slowly to the outer edges in a soft circular pattern.

To clean the focus lens, remove it from the laser head, clean it in the same way as the mirrors, and then replace it. During replacement, be mindful to leave the concave side facing down.

## **Cleaning the Main Bay and Engraver**

Check at least once a day whether dust has accumulated in the main engraving bay. If so, it must be removed. The exact cleaning interval and requirements strongly depend on the material being processed and the operating time of the device. A clean machine guarantees optimal performance and reduces service costs, as well as reducing the risk of fire or injury.

Clean the viewing window with mild cleansers and a lens or cotton cloth. **DO NOT** use paper towels as they can scratch the window and reduce the cover's ability to protect you from laser radiation. Clean the interior of the main bay thoroughly, removing any debris particles or deposits. Paper towels and window cleaner are recommended. When necessary, clean the cover of the laser tube after it has been allowed to cool completely. Allow any fluid used in any cleaning to dry completely before further use of the engraver.

## **Replacing the Water and Cleaning the Tank & Pump**

Because distilled water can leach chemicals from your tank and/or hoses and spread these possibly corrosive particles to the laser tube, change your water each week regardless of its level or clarity to maximize your laser's service life.

While changing the water, clean the tank and pump completely to minimize any buildup of residue or chemicals. Turn off the laser engraver and unplug the pump. Open the water tank, remove the pump, and clean both. Disconnect the pump's blue hose, allowing it to drain, and clean it if needed. Reconnect the hose and replace the pump inside the tank. Add your new water to the tank. Plug the pump in again and allow it to run for 2–3 minutes to restore the water throughout the engraver's cooling system. Before starting the laser, visually confirm water is running through the laser tube without bubbles and check the water temperature.

## **Cleaning the Exhaust System**

After long periods of use, the inside of the fan will accumulate dust, making it less effective at removing fumes and dust produced by engraving. The rate of dust accumulation will vary depending on the materials processed and the working environment's air quality. Check for excessive dust at least once a week and clean the exhaust system as needed. Always cease work and clean your exhaust system if you ever notice the fan making more noise than usual. Turn off the laser engraver, remove the exhaust pipe, and remove any dust from the exposed fan. Clean the exhaust pipe itself before reconnecting it to the fan. If water is used, allow the pipe to dry completely before reattaching it.

Additionally, clean any dust or debris from the engraver's side vents as needed.

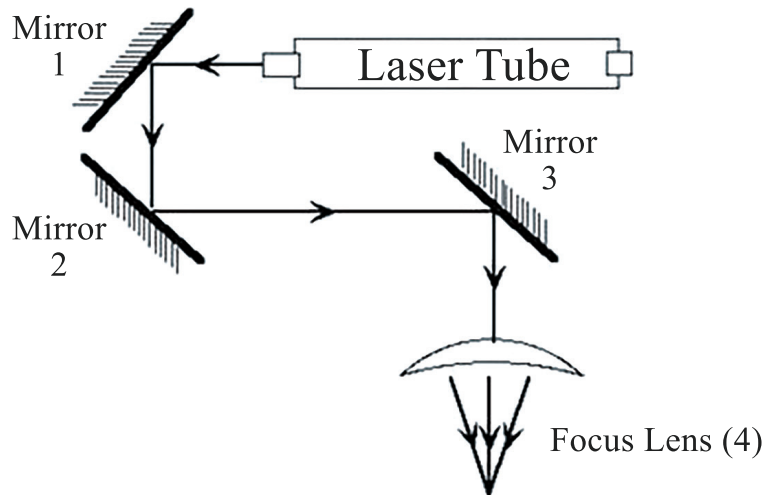
## **Cleaning and Lubricating the Guide Rails**

For best results, clean and lubricate the engraver's guide rails every two weeks. Turn off the laser engraver. Move the laser head out of the way to the far right or left. Wipe away all dust and debris along the rails with a dry cotton cloth until it is shiny and clean. Next, lubricate the guide rails and screws with white lithium grease. Gently move the laser head and X axis to distribute the lubricant evenly along both rails.

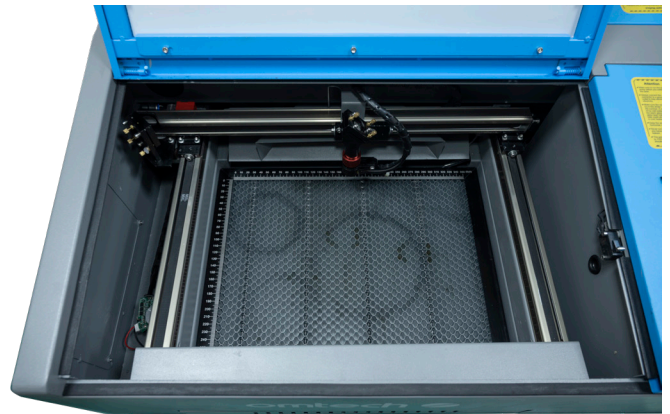




## 5.3 Laser Path Alignment

Having a proper beam alignment is important for the machine's overall efficiency and the quality of its work. This machine went through a complete beam alignment before shipping. When the engraver first arrives and about once a week during normal operation, however, it is recommended that users confirm that alignment is still at acceptable levels and that the mirrors and focus lens have not shifted due to movement of the machine.



You will need to place a piece of tape at each stage of the laser path, marking it to confirm that that stage remains correctly aligned. When it is not, you will use the laser tube's brackets or the screws on the back of the misaligned mirror to correct the problem. Once the provided tape runs out, we recommend masking tape as it is easy to manage and use.



-  Performing a beam alignment can expose the operator to small amounts of radiation if performed carelessly. Follow these procedures correctly and always take caution when performing a beam alignment.
-  Perform a beam alignment at low power levels. 8 mA or 11% should be sufficient to leave a clear mark without igniting the testing tape.

### 5.3.1 Laser Tube Alignment

To test the alignment of the laser tube with the 1st mirror, cut out a piece of tape and place it on the mirror's frame.

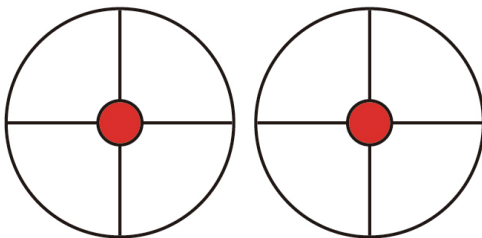


**DO NOT** place the tape directly onto the mirror. Turn on the machine and set the power level to 11% or lower.

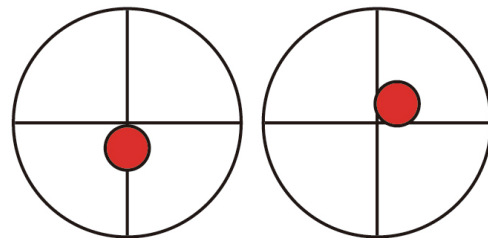
Fire the laser. You should be able to see a small mark on the tape. If it is not noticeable, fire the laser again.



Always make sure the path is clear between the laser and its target. Never allow foreign objects between the laser and its target. Always close the cover before firing the laser. Do not look directly at the active laser through the cover during this procedure.



These marks are OK.

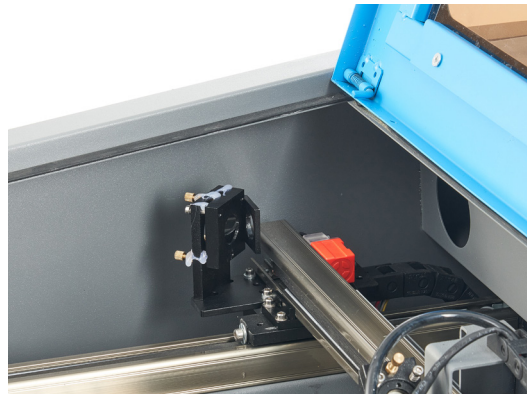


These marks require adjustment.

The laser mark should be near the center of the hole. If the laser is not centered on the 1st mirror, cut the power to your laser and carefully adjust the laser tube in its brackets. This may require loosening its fasteners. Be careful not to overloosen any bolts and not to overtighten them. Only adjust one stand at a time.

### 5.3.2 1st Mirror Alignment

After ensuring the laser is well aligned between the laser tube and 1st mirror, check the alignment between the 1st and 2nd mirrors. First, gently move the X axis rail along the Y axis to send the 2nd mirror to the back of the bed.

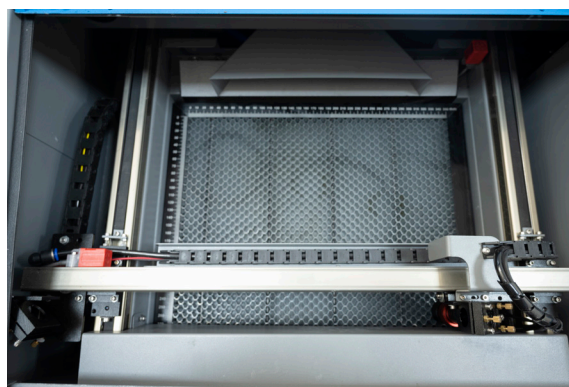


Once set, place a piece of tape on the 2nd mirror's frame. **DO NOT** place the tape directly onto the mirror. Repeat the steps from §5.3.1. If the laser is not centered on the 2nd mirror, you will need to adjust the 1st mirror's set screws accordingly. For larger adjustments, you may need to loosen the mounting bolts at the mirror's base to slide it into better position before fine tuning with the adjustment screws.



To adjust the mirror, loosen the nut on the screw and then slightly turn the screw either clockwise or counterclockwise. Each screw adjusts a different position or angle. Keep track of which screw you are adjusting and the direction of adjustment. Do not turn the screw more than  $\frac{1}{4}$  turn at a time and, especially at first, test the position of the laser after each adjustment so that you learn the effect of each change. Test until the beam is well aligned and then retighten the nuts on the screws once all adjustments are completed.

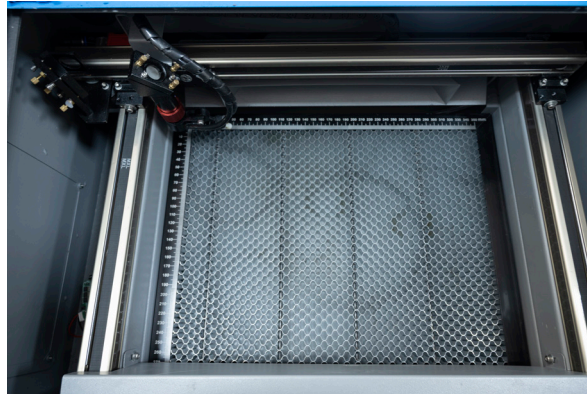
Next, gently move the X axis rail along the Y axis to bring the 2nd mirror to the front of the bed.



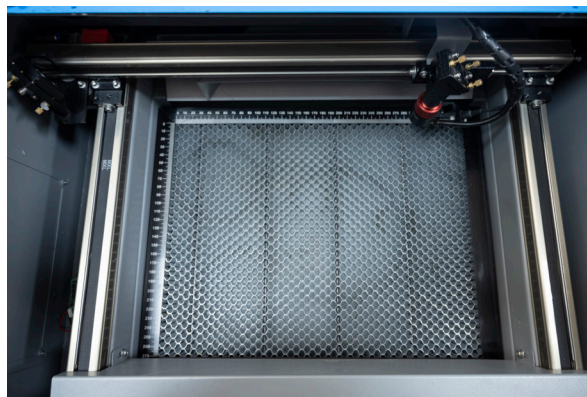
Once set, place another piece of tape on the 2nd mirror's frame. **DO NOT** place the tape directly onto the mirror. Repeat the steps from §5.3.1 and, if necessary, adjust the set screws on the 1st mirror. Test again until the beam is well aligned and retighten the nuts on the set screws.

### **5.3.3 2nd Mirror Alignment**

After ensuring the laser is well aligned between the 1st and 2nd mirrors, check the alignment between the 2nd and 3rd mirrors. Gently move the X axis rail along the Y axis to send the 2nd mirror to the back of the bed. Gently move the laser head along the X axis to the far left. Repeat the steps and adjustments above, taking care to use the tape on the mirror's frame and not its surface.



Gently move the laser head along the X axis to the far right. Repeat the steps and adjustments above, again taking care to use the tape on the mirror's frame and not its surface.



### **5.3.4 3rd Mirror Alignment**

After ensuring the laser is well aligned between the 2nd and 3rd mirrors, check the alignment between the 3rd mirror and the workbed. First, unplug the air assist hose from the laser head. Then, place a piece of tape across the bottom of the laser head and press it onto the nozzle with some force. This will leave a ring mark that can help you check the accuracy. Repeat the steps from §5.3.1. The 3rd mirror does not have fine adjustment screws so, if the laser is not centered through the laser head, loosen the laser head's mounting bolts and move its base plate in small increments. Test again until the beam is well aligned and retighten the mounting bolts.

## **5.4 Parts Replacement**

The engraver should not be modified or disassembled by anyone except trained and skilled professionals, but some consumable parts may require replacement after prolonged use. Be sure only to use identical or compatible replacement parts with this engraver. Contact your vendor or our technicians if you have any questions about fitment. Using incompatible components is highly dangerous and waives all the manufacturer's liability for any damage or injury caused.



**ALWAYS** completely disconnect the engraver from its power supply before replacing any parts.

## 5.5 Troubleshooting

The following solutions should quickly solve the most common problems users encounter. Should an issue arise beyond the scope of these troubleshooting tips, contact our customer service support team or a trained repair professional for help.

### **Nothing happens when the engraver is turned on.**

Check that the engraver's power cord and any intermediary surge protector are both firmly connected with a stable compatible power supply. Check the engraver and any surge protector's fuses to see if they have burnt out and require replacement.

### **The laser beam does not fire.**

Check that the water cooling system is working properly and the tank is well supplied with cool (but not icy) distilled water. Check the laser's path for misalignment and, if necessary, perform the adjustment procedure as discussed in §5.3.

### **The laser begins firing continuously.**

Check that the power cord is using a fully grounded outlet. If this cannot be provided or determined, use the separate grounding wire as discussed in §3.6.

### **The laser head behaves erratically.**

Adjust the limit switches on each rail to make sure they are behaving properly. Check that the laser is well grounded. Reduce the speed parameters for your design, adjusting the power level as necessary.

## 5.6 Disposal Instructions



Electrical products should not be disposed of with household products. In the EU and UK, according to the European Directive 2012/19/EU for the disposal of electrical and electronic equipment and its implementation in national laws, used electrical products must be collected separately and disposed of at the collection points provided for this purpose. Locations in Australia, Canada, and the United States may have similar regulations. Contact your local authorities or dealer for disposal and recycling advice.

## Contact Us

Thank you for choosing our laser equipment for your home or shop! For a .pdf copy of the latest version of this manual, use the appropriate app on your smartphone or other device to scan the QR code to the right.

Come join the OMTech community at our official laser group on Facebook or visit the company forums at **omtechlaser.com!** Check our YouTube channel for helpful hints and instructional videos. If you encounter any problem regarding your engraver, do not hesitate to contact customer service with your order number at **help@cs-supportpro.com** or **techsupport@omtechlaser.com**. Our teams will respond within 24 hours to make things right. You can also reach us Monday to Friday at (949) 539-0458 between 8 am and 4:30 pm PST.

Thank you and we hope you will choose us again for all your laser needs!

